AD NUMBER

ADB003783

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

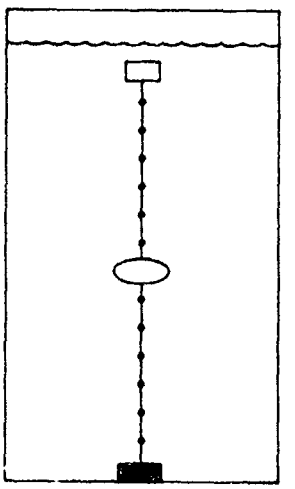
FROM

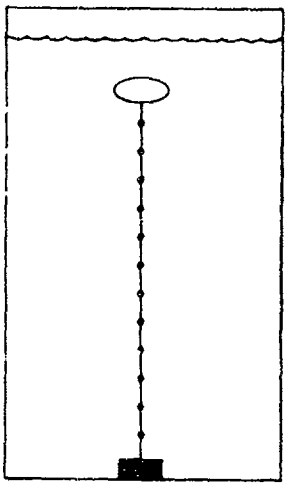
Distribution authorized to U.S. Gov't. agencies only; Test and Evaluation; 04 APR 1975. Other requests shall be referred to Officer-in-Charge, Naval Underwater Systems Center, New London, CT 06320.

AUTHORITY

CNO/N772 ltr N772A/6U875630 20 Jan 2006 and ONR ltr 31 Jan 2006

# The Moored Acoustic Buoy System (MABS)

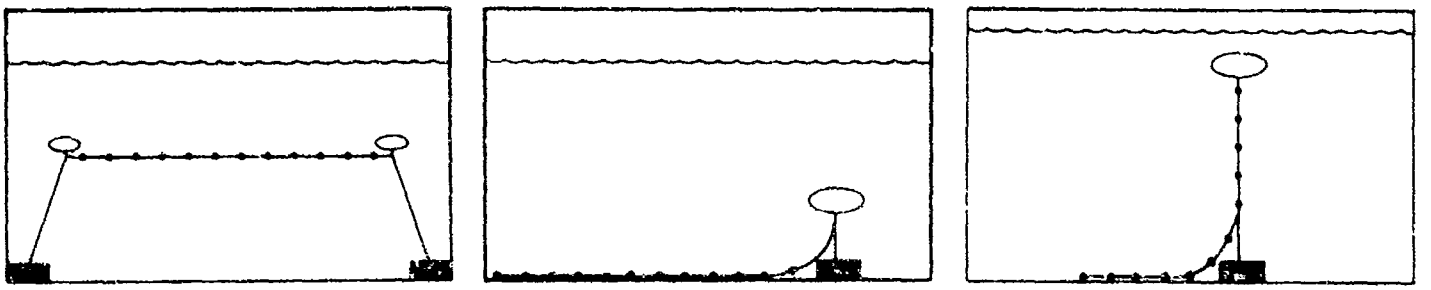




Robert F. LaPlante
Raymond W. Hasse

OCEAN SCIENCES & TECHNOLOGY DEPARTMENT

4 April 1975



NAVAL UNDERWATER SYSTEMS CENTER
New London Laboratory

PREFACE

This report was prepared under NUSC Project No. 012345,

STA000, Ocean Sciences & Technology Department Indirect.

REVIEWED AND APPROVED: 4 April 1975

R. W. Hasse
Associate Director for Sonar Research

The authors of this report are located at the New London Laboratory, Naval Underwater Systems Center, New London, Connecticut 06320.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|---|---|
| 1. REPORT NUMBER<br>TD 4937 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE *(and Subtitle)*<br>THE MOORED ACOUSTIC BUOY SYSTEM (MABS) | | 5. TYPE OF REPORT & PERIOD COVERED |
| | | 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s)<br>Robert F. LaPlante<br>Raymond W. Hasse | | 8. CONTRACT OR GRANT NUMBER(s) |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>Naval Underwater Systems Center<br>New London Laboratory<br>New London, Connecticut 06320 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS<br>012345 |
| 11. CONTROLLING OFFICE NAME AND ADDRESS<br>Naval Underwater Systems Center<br>New London Laboratory<br>New London, Connecticut 06320 | | 12. REPORT DATE<br>4 April 1975<br>13. NUMBER OF PAGES<br>14 |
| 14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)* | | 15. SECURITY CLASS. *(of this report)*<br>UNCLASSIFIED<br>15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |

16. DISTRIBUTION STATEMENT *(of this Report)*

Distribution limited to U. S. Government Agencies only; Test and Evaluation: 4 April 1975. Other requests for this document must be referred to the Naval Underwater Systems Center.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Moored Acoustic Buoy System
MABS
Underwater Acoustic Data Recording

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The Moored Acoustic Buoy System (MABS) is a bottom-moored programmable acoustic data recording system. The system, which incorporates recent developments in lightweight synthetic cables, can be deployed at ocean depths in a variety of configurations from modest ocean-going vessels. Having been used in 19 previous deployments, the system has evolved into a complete, reliable, versatile, easily handled acoustic data gathering tool. Flexible programming options allow delayed start, selectable sample intervals, and selectable sample

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

durations so that deployments of up to 7 months are possible with a maximum of 14 days of continuous recording. The outputs of as many as 13 hydrophones can be recorded simultaneously from the acoustic array. The present MABS inventory consists of three instrumentation pressure vessels, four flotation buoys, three tape recorders (two different types), many array cables, and a complement of auxiliary gear.

# TABLE OF CONTENTS

## LIST OF ILLUSTRATIONS



## LIST OF TABLES

# THE MOORED ACOUSTIC BUOY SYSTEM (MABS)

## INTRODUCTION

The Moored Acoustic Buoy System (MABS) is a bottom-moored programmable acoustic data recording system. It consists of a subsurface instrumentation buoy in conjunction with a family of lightweight hydrophone arrays designed to measure a variety of underwater acoustic signals. The MABS equipment can be used in any water depth. It can be laid on the ocean bottom or suspended at any attitude from vertical to horizontal in the water column. Recent developments in lightweight synthetic-cable technology have been incorporated into the design to make MABS deployable from the most modest of ocean-going ships in a wide range of sea states with a minimum of support equipment and personnel. To date, MABS systems have been used in 19 deployments and retrievals in the Atlantic and Pacific Oceans and in the Caribbean and Mediterranean Seas.

## SYSTEM DESCRIPTION

Basically, MABS is both a concept and a realization. Thus, the system appears in a variety of forms with various capabilities. The basic concept was to produce a rapidly deployable, programmable, self-recording, multichannel system that can be deployed for periods up to 7 months, is highly reliable, and requires little if any ship outfitting.* Figure 1 depicts a variety of configurations in which MABS can be deployed.

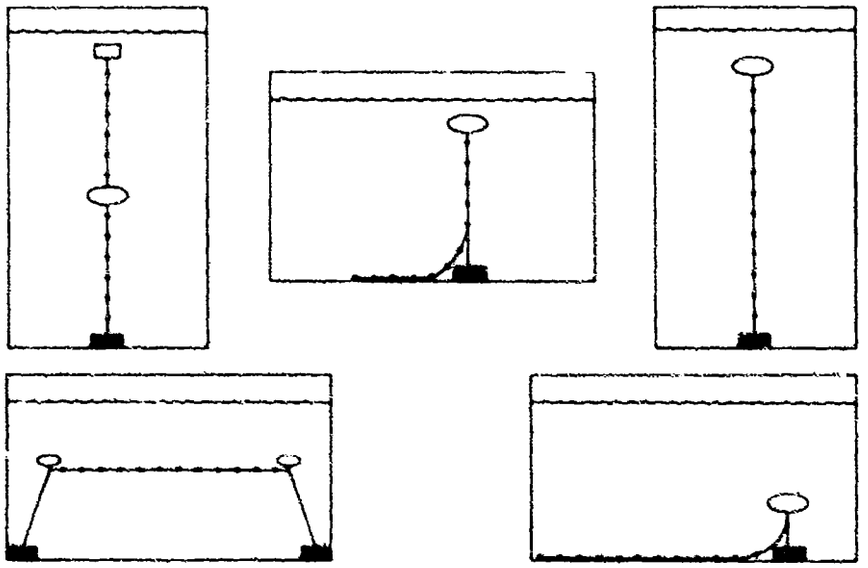


Figure 1. MABS Array Configurations

*For further information on MABS and its earlier development, see P. C. King and R. C. Swenson, Moored Acoustic Buoy System (MABS): Specifications and Deployments, NUSC TR 4457, 5 January 1973 (UNCLASSIFIED).

The major components of the basic MABS equipment are the instrumentation pressure vessel (IPV), battery pack, flotation buoy, electromechanical cable, hydrophones, acoustic telemeter, acoustic transponder/releases, recovery package, and anchor.

Figure 2 shows the MABS II buoy, consisting of the IPV, battery pack, syntactic foam flotation unit, acoustic telemeter, and recovery-aiding light and radio beacons. Figure 3 depicts the similarly constructed MABS I buoy. The MABS II flotation buoy is 7.5 ft in diameter by 3.5 ft high and is constructed of high-density syntactic foam protected by a rubber bumper around the rim. The flotation buoy serves a dual purpose in providing both buoyancy and protection to the IPV. Twelve hundred pounds of buoyancy provides enough reserve buoyancy to recover the system should the IPV completely flood. The buoy was designed to fit through most shipboard A-frames and also to fit inside standard van trailers for ease of transport.

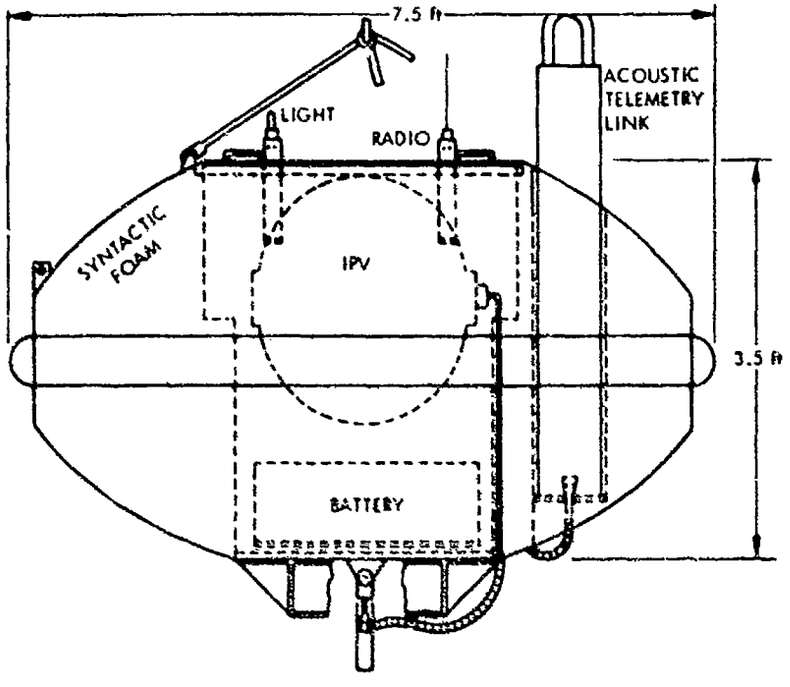



Figure 2. MABS II Buoy

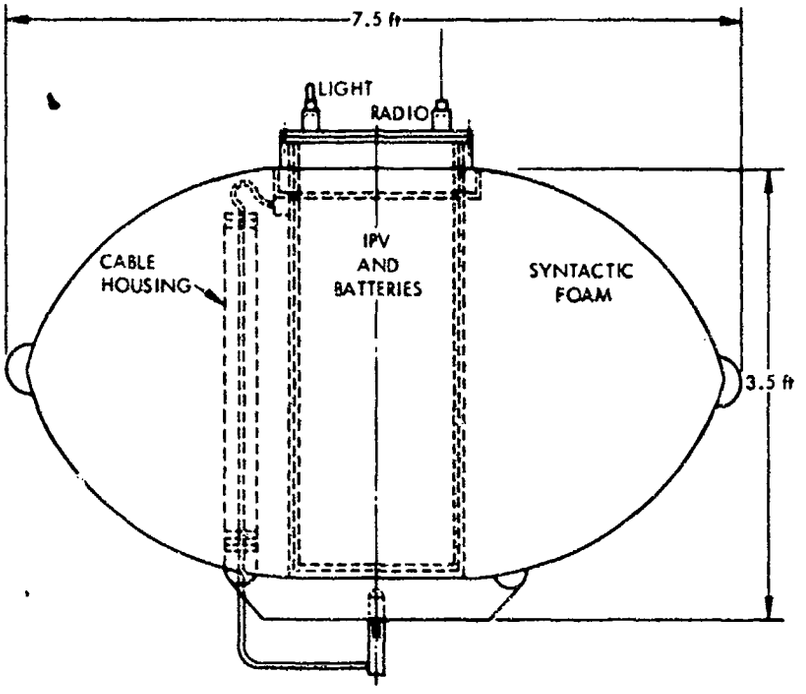



Figure 3. MABS I Buoy

The system electronics, logic circuits, and tape recorder are located in the 28-in.-diameter aluminum IPV. Two different types of tape recorders are incorporated into the MABS system and can be used interchangeably in MABS II. One, for long-time signal-amplitude measurements, has a total recording time of over 13 days. The other, with high cross-channel stability for coherence-type measurements, has a total recording time of 16 hours. With selection of suitable duty cycles, recording times can be extended to 7 months. Also in the IPV is an IRIG B time-code generator that controls the system timing and is recorded on one track of the tape recorder, providing a continuous accurate record of time on tape. The logic and timing circuits provide a wide range of programming options for data collection (see table 1). Data can be sampled continuously or at intervals from 10 sec to 9 hr for periods of 10 sec or more. Random noise and sine wave calibrations can be recorded automatically with every data sample or less frequently as desired.

Table 1. General Operating Characteristics of MABS

A. Programming Options

Time interval between samples

1) Continuous

2) 10 to 60 sec in 10-sec increments

3) 1 to 10 min in 1-min increments

4) 10 to 90 min in 10-min increments

5) 1 to 9 hr in 1-hr increments

6) adjustable to requirements

Length of sample

1) Continuous

2) 10, 15, 30, or 60 sec

3) adjustable to requirements

Delayed start (MABS II only)

1 hr to 90 days

B. Calibration: Random Noise and Sine Wave, Automatically at Any Interval Desired

C. Total Record Time With Astro-Science Mars 2000 Recorder

1-7/8 IPS*: 8 hr

15/16 IPS : 16 hr

D. Total Record Time With Precision Instruments 5114 Recorder

15/160 IPS: 328 hr

E. Maximum Deployed Time

7 months

---

*Inches per second (IPS)

The tape recorders available for use with MABS are the Astro-Science Mars 2000 precision recorder and the Precision Instruments 5114 recorder. The specifications of the two recorders are summarized in table 2. All recorders are 14-channel units. The Mars 2000 unit was chosen for its wide bandwidth and rigid skew specifications, which are necessary for beamforming and coherence measurements. The Precision Instruments recorder is suitable for recording ambient noise, CW and explosive shot signals, and ship signatures for long periods of time. The MABS recorders can be used in a split gain configuration where each acoustic data channel is recorded simultaneously on two tracks at two levels with some overlap in dynamic range or with one data channel per magnetic tape channel. The split gain option provides the necessary extended dynamic range for high-amplitude transient data while facilitating data processing by maintaining constant calibration factors for each channel throughout the data. Thirteen hydrophone channels are normally available with MABS, with one tape channel reserved for time-code signals. With a split gain mode of operation for all hydrophones, a maximum of six hydrophones can be monitored.

Table 2. Specifications of Tape Recorders Used in MABS

| Manufacturer and Model | Astro-Science Mars 2000 | | | | Precision Instruments 5114 | |
|---|---|---|---|---|---|---|
| Tape Speed (IPS) | 1-7/8 | | 15/16 | | 15/160 | |
| Mode | Direct | FM | Direct | FM | Direct | Direct extended band |
| Total Record Time (hr) | 8 | | 16 | | 328 | |
| Bandwidth (kHz) | 0.4-32 | 0-2.5 | 0.4-16 | 0-1.25 | 0.001-0.375 | 0.001-0.750 |
| Dynamic Range (dB) | 20 | 40 | 15 | 35 | 35 | 24 |
| Dynamic Skew (μin.) | ±25 | | ~~±50~~ 25 | | -- | -- |
| Wow and Flutter (percent) | 1 | | 1.8 | | -- | -- |
| No. of Channels | 14 | | 14 | | 14 | 14 |

Lightweight synthetic-fiber (Kevlar 29) electromechanical cables are utilized in the system. These cables are completely faired with a hairy type of fairing to reduce cable strum and vibration that might otherwise contaminate low frequency acoustic signals and ambient noise. The hydrophone cages are designed to be inserted into the cable without cutting the strength members or nonrequired conductors. The hydrophone assemblies are small, light, and reliable, employing pressure-insensitive electronics in a completely molded package that requires no pressure housing. Figure 4 shows the synthetic cable, hydrophone, and hydrophone cage before the hydrophone is inserted into the cable. Each hydrophone and cage can be incorporated

within the matrices of fiber strands and conductors of the cable in less than 3 hours. This operation can be done in the laboratory or aboard ship. The hydrophone forms a smooth bulge of increased cross-sectional diameter. The cable with the hydrophones can be wound easily around a winch drum and will pass through sheaves with little or no special attention during deployment and retrieval. With this arrangement, the hydrophones are readily available for testing and calibration as part of the total array, and pressure testing of the complete array before going to sea is easily accomplished. Additionally, the fiber cable, being light and easy to handle, requires little or no additional flotation along its length to support its weight as in the case of steel cables. Because it does not corrode, the cable requires no maintenance in use or storage.

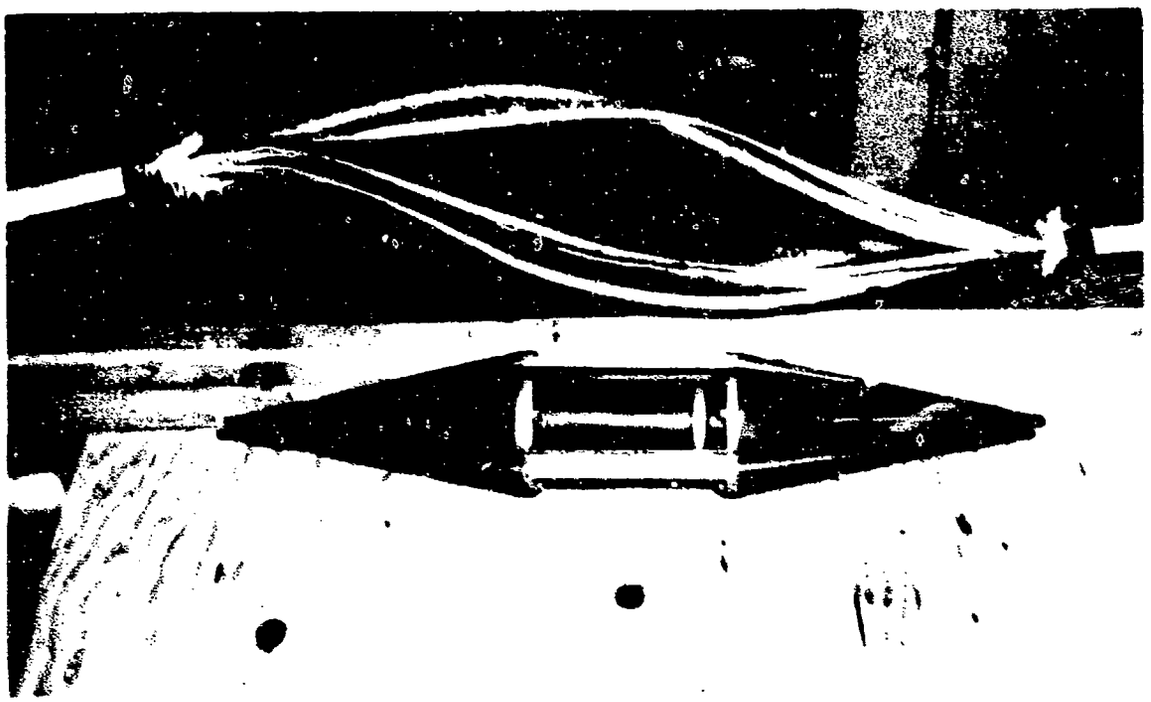


Figure 4. MABS Hydrophone and Cable

The power for MABS is supplied by a battery pack of lead-acid or silver-zinc batteries. The battery pack can be easily replaced for quick turnaround times.

The MABS equipment is capable of transmitting information about its status to a surface vessel or platform. Such information as battery voltage, buoy depth, system operation, presence of leaks in the IPV, and water temperature is available aboard the deployment vessel. A more complete list of interrogation options can be found in table 3.

Table 3. Acoustic Telemeter Interrogation Modes for MABS II

| Mode | Command from | Action |
|---|---|---|
| 1 | Surface unit | Acts as a transponder |
| 2 | Internal logic circuitry | Interrogates bottomed transponders |
| 3 | Surface unit | Sends 5 min of data for five of the following parameters --<br><br>Depth,<br>Water temperature,<br>Signal level (at recorder),<br>Battery voltage,<br>Leak detector status,<br>System mode or status, and/or other parameters. |
| 4 | Surface unit | Sends 5 min of data for five parameters with next data sample |
| 5 | Surface unit | Changes mode or status of programmer in buoy. |

A dual, parallel, acoustic transponder/release system is used just above the anchor for recovering the system. In the transponder mode, these units assist in pinpointing the location of MABS. The parallel release provides 100-percent redundancy for the system release function.

## DEPLOYMENT AND RETRIEVAL

The MABS equipment has been used most frequently in a vertical attitude. In this attitude, MABS is deployed anchor last to free-fall to the bottom with the buoy at the top of the array. Because MABS is a total, complete system prior to deployment, it is not necessary to stop the cable for sensor, float, or connector attachment, and there is little payout tension. Deployment and retrieval times are typically about 1-2 hours. The system is designed to be deployable from small ships in wind speeds to 20 knots and wave heights to 12 ft. It has been recovered in 40-knot winds. Little winching capability is required for MABS, and the only lifting capability required is for the IPV/flotation unit. Systems have been deployed and recovered 19 times in the last 3 years while operating from 6 different platforms.

## TESTING AND CALIBRATION

Before it goes to sea, the MABS system is completely fabricated and the entire array is pressure tested in the pressure tank at NUSC. This process ensures the integrity of the complete system prior to deployment.

Various calibration procedures are used. A calibration is performed on each hydrophone at the Naval Research Laboratory, Underwater Sound Reference Division (NRL/USRD) Orlando before and after each exercise. Complete system end-to-end calibrations are also performed before and after exercises. These system calibrations consist of injecting a series of tonals and wideband noise signals at the input of the hydrophone preamplifiers and recording these signals on the system tape recorder. Additionally, calibration signals in the form of wideband noise plus a single tone are injected at the input of the IPV and recorded on tape at preprogrammed intervals while the system is deployed and operating.

## SUMMARY

MABS is a versatile, reliable, easily handled, acoustic data gathering tool. It can be deployed and retrieved from a wide class of surface platforms without requiring specialized handling gear, numerous personnel, or large deck areas. With the option to interchangeably use two separate tape recorders with different capabilities, it can accomplish data gathering for a wide variety of underwater acoustic experiments.

Utilizing the newest developments in synthetic cable and hydrophone array components, MABS is a weather-hardened, lightweight system that can be deployed in a variety of configurations (figure 1). The IPV unit is capable of deployment to depths from 100 to 12,000 ft with the array sensors at any depth below or above the IPV. Table 4 summarizes the important specifications of MABS II, one of the series of MABS equipments; table 5 summarizes the specifications of MABS I. Figure 5 depicts the combinations that are possible with the existing MABS hardware. This hardware includes four flotation buoys, three pressure vessels, three tape recorders, five arrays, and a complement of acoustic releases and other marine hardware.

Table 4. Specifications for MABS II

| Component Descriptor | Pertinent Data | |
|---|---|---|
| **Buoy Module** | | |
| Size: pressure vessel | 28-in.-diameter sphere | |
| assembly | 7.5-ft-diameter by 3.5-ft-high spheroid | |
| Weight of IPV | 850 lb in air | |
| Maximum buoy depth | 12,000 ft | |
| **Hydrophone Array** | | |
| Cable type | Synthetic fiber or steel | |
| Hydrophone type | ITC model 8021 or 8014 | |
| Hydrophone assembly size | 2 ft long by 4 in. diameter | |
| Hydrophone assembly weight | 3 lb in water | |
| **Tape Recorders** | | |
| Manufacturer/Model | Astro-Science Mars 2000 | Precision Instruments 5114 |
| Dynamic range | 40 db FM, 20 db direct | 30 db direct |
| Dynamic range expansion | Yes, split gain | Yes, split gain |
| Tape duration | 8 hr at 1-7/8 IPS<br>16 hr at 15/16 IPS | 328 hrs at 15/160 IPS |
| Data tracks | 14 | 14 |
| Acoustic data channels | 13 | 13 |
| Record method | FM, direct | Direct |
| Frequency response | FM<br>3-1250 Hz at 15/16 IPS<br>3-2500 Hz at 1-7/8 IPS<br>Direct<br>400-16,000 Hz at 15/16 IPS<br>400-32,000 Hz at 1-7/8 IPS | 3-375 Hz or<br>3-750 Hz (extended band) |
| **Array Parameters** | | |
| Maximum number of hydrophones | 13 | |
| Allowable sample lengths | 10 sec minimum to continuous | |
| Interval between samples | 10 sec to 9 hr or adjustable as desired | |
| Maximum active deployment time | 7 months | |
| Maximum delayed start | 90 days | |
| Interrogation modes | 5 | |

Table 5. Specifications for MABS I

| Component Descriptor | Pertinent Data |
|---|---|
| **Buoy Module** | |
| Size: pressure vessel assembly | 16-in. by 44-in. cylinder<br>7.5-ft-diameter by 3.5-ft-high spheroid |
| Weight of IPV | 300 lb in air |
| Maximum buoy depth | 600 ft |
| **Hydrophone Array** | |
| Cable type | Synthetic fiber or steel |
| Hydrophone type | ITC model 8021 or 8014 |
| Hydrophone assembly size | 2 ft long by 4 in. diameter |
| Hydrophone assembly weight | 3 lb in water |
| **Tape Recorder** | |
| Manufacturer/Model | Astro-Science Mars 2000 |
| Dynamic range | 40 db FM, 20 db direct |
| Dynamic range expansion | Yes, split gain |
| Tape duration | 8 hr at 1-7/8 IPS<br>16 hr at 15/16 IPS |
| Data tracks | 14 |
| Acoustic data channels | 13 |
| Record method | FM, direct |
| Frequency response | FM<br>3-1250 Hz at 15/16 IPS<br>3-2500 Hz at 1-7/8 IPS<br>Direct<br>400-16,000 Hz at 15/16 IPS<br>400-32,000 Hz at 1-7/8 IPS |
| **Array Parameters** | |
| Maximum number of hydrophones | 6 |
| Allowable sample lengths | 30 sec minimum to continuous |
| Interval between samples | 1 min to 1 hr or adjustable as desired |
| Maximum active deployment time | 7 months |
| Delayed start | None |
| Interrogation modes | None |

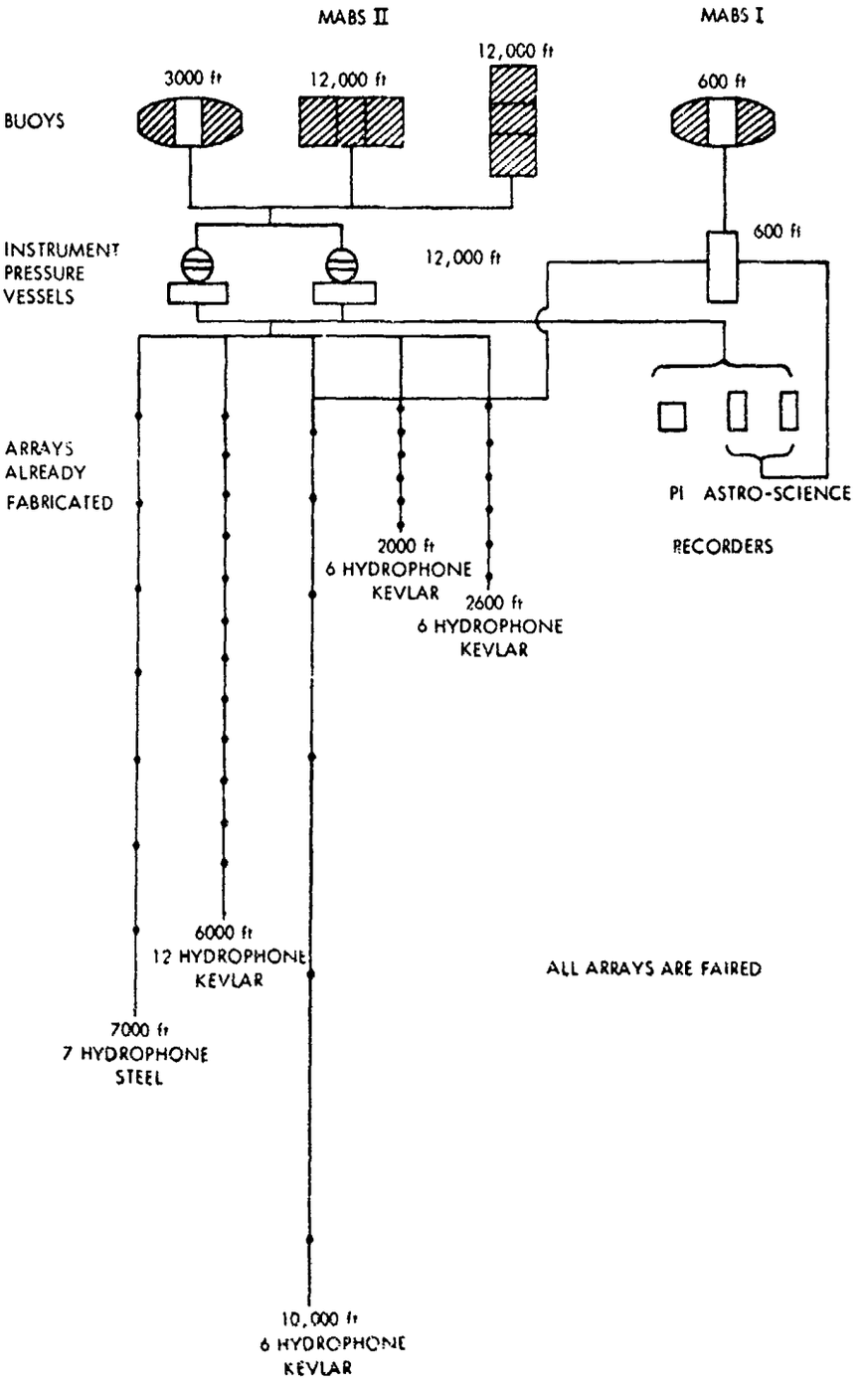



Figure 5. Possible Combinations of MABS Equipment



REVERSE BLANK

# INITIAL DISTRIBUTION LIST

| Addressee | No. of Copies |
|---|---|
| COMSUBDEVGRUTWO | 1 |
| ASN (R&D) | 1 |
| ONR, Code 102-OS | 2 |
| Code 412-3 | 1 |
| Code 480 | 1 |
| Code 485 | 1 |
| Code 410 | 1 |
| Code 102-OSC | 4 |
| CNO, Op-095 | 1 |
| Op-098 | 1 |
| Op-953 | 1 |
| Op-96C | 1 |
| Op-981H | 1 |
| CNM, MAT-03 | 1 |
| MAT-03L4 | 1 |
| MAT-0302 | 1 |
| MAT-034 | 1 |
| ASW-14 | 1 |
| ASW-23 | 1 |
| ASW-24 | 1 |
| DDR&E (G. Cann, S. Peterson) | 2 |
| NRL | 1 |
| NRL (Underwater Sound Reference Division) | 1 |
| OCEANAV | 1 |
| NAVOCEANO, Code 02 | 1 |
| Code 037 | 1 |
| Code 3400 | 1 |
| Code 6000 | 1 |
| Code 7200 | 1 |
| Code 9320 | 1 |
| NAVELEX, Code 03 | 1 |
| Code 032C | 1 |
| Code 320 | 2 |
| PME-124 | 1 |
| PME-124-20 | 1 |
| PME-124-30 (1) (J. Reeves (1)) | 2 |
| PME-124-40 | 1 |
| PME-124-60 (1) (L. Treitel (1)) | 2 |
| NAVSEA, SEA-03C | 1 |
| SEA-06H | 1 |
| SEA-06H1 | 1 |
| SEA-06H1-1 | 1 |
| SEA-06H1-3 | 1 |
| SEA-06H1-4 | 1 |

## INITIAL DISTRIBUTION LIST (Cont'd)

| Addressee | No. of Copies |
|---|---|
| NAVSEA, SEA-09G3 | 4 |
| SEA-660E | 1 |
| SEA-660F | 1 |
| NADC, Warminster | 2 |
| NWC, China Lake | 1 |
| NSRDL, Bethesda | 1 |
| NCSL, Panama City | 2 |
| NCEL, P. Hueneme | 1 |
| NSWC | 1 |
| NELC, San Diego | 1 |
| NUC, San Diego (2), (Code 5004 (1)) | 3 |
| NAVSHPYD, Puget Sound | 1 |
| NAVSHPYD, Pearl Harbor | 1 |
| NAVPGSCOL, Monterey | 1 |
| APL/UW | 1 |
| ARL/Penn State | 1 |
| DDC, Alexandria | 2 |
| MPL/Scripps | 1 |
| NOAA/ERL | 1 |
| National Research Council, Committee on Undersea Warfare | 1 |
| WHOI | 1 |

**DEPARTMENT OF THE NAVY**
OFFICE OF NAVAL RESEARCH
875 NORTH RANDOLPH STREET
SUITE 1425
ARLINGTON VA 22203-1995

IN REPLY REFER TO:

5510/1
Ser 321OA/011/06
31 Jan 06

MEMORANDUM FOR DISTRIBUTION LIST

Subj: DECLASSIFICATION OF LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP) DOCUMENTS

Ref: (a) SECNAVINST 5510.36

Encl: (1) List of DECLASSIFIED LRAPP Documents

1. In accordance with reference (a), a declassification review has been conducted on a number of classified LRAPP documents.

2. The LRAPP documents listed in enclosure (1) have been downgraded to UNCLASSIFIED and have been approved for public release. These documents should be remarked as follows:

   Classification changed to UNCLASSIFIED by authority of the Chief of Naval Operations (N772) letter N772A/6U875630, 20 January 2006.

   DISTRIBUTION STATEMENT A: Approved for Public Release; Distribution is unlimited.

3. Questions may be directed to the undersigned on (703) 696-4619, DSN 426-4619.

BRIAN LINK
By direction

Subj: DECLASSIFICATION OF LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP) DOCUMENTS

DISTRIBUTION LIST:

NAVOCEANO (Code N121LC – Jaime Ratliff)
NRL Washington (Code 5596.3 – Mary Templeman)
PEO LMW Det San Diego (PMS 181)
DTIC-OCQ (Larry Downing)
ARL, U of Texas
Blue Sea Corporation (Dr.Roy Gaul)
ONR 32B (CAPT Paul Stewart)
ONR 321OA (Dr. Ellen Livingston)
APL, U of Washington
APL, Johns Hopkins University
ARL, Penn State University
MPL of Scripps Institution of Oceanography
WHOI
NAVSEA
NAVAIR
NUWC
SAIC

# Declassified LRAPP Documents

| Report Number | Personal Author | Title | Publication Source (Originator) | Pub. Date | Current Availability | Class. |
|---|---|---|---|---|---|---|
| 55 | Weinstein, M. S., et al. | SUS QUALITY ASSESSMENT, SQUARE DEAL | Undersea Systems, Inc. | 750207 | ADA007559; ND | U |
| BKD2380 | Unavailable | WESTLANT 74 PHASE 1 DATA SUMMARY (U) | B-K Dyanmics, Inc. | 750301 | NS; ND | U |
| TM-SA23-C44-75 | Wilcox, J. D. | MOTION MODEL VALIDATION FROM LRAPP ATLANTIC TEST BED DATA | Naval Underwater Systems Center | 750317 | ND | U |
| RAFF7412; 74-482 | Scheu, J. E. | SQUARE DEAL SHIPPING DENSITIES (U) | Raff Associates, Inc. | 750401 | ADC003198; NS; ND | U |
| PSI TR-004018 | Barnes, A. E., et al. | ON THE ESTIMATION OF SHIPPING DENSITIES FROM OBSERVED DATA | Planning Systems Inc. | 750401 | ND AD 096582 | U |
| NUSC TD No.4937 | LaPlante, R. F., et al. | THE MOORED ACOUSTIC BUOY SYSTEM (MABS) | Naval Underwater Systems Center | 750404 | ADB003783; ND | U |
| USI 460-1-75 | Weinstein, M. S., et al. | SUS SIGNAL DATA PROCESSING (U) INVESTIGATIONS CONDUCTED UNDER THE DIAGNOSTIC PLAN FOR CHURCH ANCHOR AND SQUARE DEAL SHOT DATA (U) | Underwater Systems, Inc. | 750414 | ADC002353; ND | U |
| Unavailable | Ellis, G. E. | SUMMARY OF ENVIRONMENTAL ACOUSTIC DATA PROCESSING | University of Texas, Applied Research Laboratories | 750618 | ADA011836 | U |
| Unavailable | Edelblute, D. J. | OCEANOGRAPHIC MEASUREMENT SYSTEM TEST AT SANTA CRUZ ACOUSTIC RANGE FACILITY (SCARF) | Lockheed Missiles and Space Co., Inc. | 751015 | ADB007190 | U |
| Unavailable | Unavailable | SUS SOURCE LEVEL COMMITTEE REPORT | Underwater Systems, Inc. | 751105 | ADA019469 | U |
| Unavailable | Hampton, L. D. | ACOUSTIC BOTTOM INTERACTION EXPERIMENT DESCRIPTION | University of Texas, Applied Research Laboratories | 760102 | ADA021330 | U |
| PSI-TR-036030 | Turk, L. A., et al. | CHURCH ANCHOR: AREA ASSESSMENT FOR TOWED ARRAYS (U) | Planning Systems Inc. | 760301 | ND | U |
| NUC TP 419 | Wagstaff, R. A., et al. | HORIZONTAL DIRECTIONALITY OF AMBIENT SEA NOISE IN THE NORTH PACIFIC OCEAN (U) | Naval Undersea Center | 760501 | ADC007023; NS; ND | U |
| NRL-MR-3316 | Young, A. M., et al. | AN ACOUSTIC MONITORING SYSTEMS FOR THE VIBROSEIS LOW-FREQUENCY UNDERWATER ACOUSTIC SOURCE | Naval Research Laboratory | 760601 | ADA028239; ND | U |
| ARL-TR-75-32 | Ellis, G. E. | SUMMARY OF ENVIRONMENTAL ACOUSTIC DATA PROCESSING | University of Texas, Applied Research Laboratories | 760705 | ADA028084; ND | U |
| Unavailable | Unavailable | SUMMARY OF ENVIRONMENTAL ACOUSTIC DATA PROCESSING | University of Texas, Computer Science Division | 761013 | ADA032562 | U |
| TTA83676285 | Unavailable | ANALYSIS PLAN FOR NARROWBAND/ NARROWBEAM AMBIENT NOISE (U) | Tetra Tech, Inc. | 761112 | ADC008275; NS; ND | U |
| USI 564-1-77 | Wallace, W. E., et al. | REPORT OF CW WORKSHOP. NORDA, BAY ST. LOUIS, MISS., 28-29 SEPT 1976 | Underwater Systems, Inc. | 770124 | ND | U |